

We claim:

1. A deck plank made of a composite of a polymer material that is formed with internal closed cells and glass fibers that are imbedded in the closed cell polymer material, said deck plank comprising:
  - a top surface;
  - a first side surface that is substantially orthogonal to said top surface;
  - a second side surface that is substantially orthogonal to said top surface and that is oppositely disposed on said deck plank from said first side surface; and
  - a bottom surface that is located between said first and second side surface and that is oppositely disposed from said top surface, said bottom surface defining a generally concave surface between said first side surface and said second side surface.
2. The deck plank of claim 1 wherein the concave surface of said bottom surface defines a generally continuous arc between said first side surface and said second side surface.
3. The deck plank of Claim 2 wherein said bottom surface defines an arc of substantially constant radius.
4. The deck plank of Claim 3 wherein the radius of said arc of said bottom surface is not less than 50 inches.
5. The deck plank of Claim 2, 3, or 4 wherein said continuous arc has a first end that joins with said first side surface and said continuous arc also has a second end that joins with said second side surface.

6. The deck plank of Claim 5 wherein the junction of the first end of said continuous arc and said first side surface defines a first curved shoulder and wherein the junction of the second end of said continuous arc and said second side surface defines a second curved shoulder.

7. The deck plank of Claim 6 wherein said first curved shoulder defines a constant radius and where said second curved shoulder also defines a constant radius.

8. The deck plank of Claim 7 wherein the radius of each of said first curved shoulder and said second curved shoulder is not greater than substantially 0.25 in.

9. A process of making deck planks, said process comprising the steps of:

blending polyvinyl chloride with glass fibers to make a polyvinyl chloride/glass melt in which the glass fibers are imbedded in the polyvinyl chloride;  
Exposing the polyvinyl chloride/glass melt to a blowing agent to form voids in the polyvinyl chloride/glass melt;

extruding the polyvinyl chloride/glass melt having included voids through a die, said extrusion die having an opening therein that is defined by first and second side surfaces that are oppositely disposed from each other and by top and bottom surfaces that are also oppositely disposed from each other and that are substantially orthogonal with respect to said first and second side surfaces;

pulling the extruded material through a calibration table wherein the extruded material is cooled as it passes through a plurality of calibrators that further define the external shape of the extruded material, each of said calibrators having a respective opening that is defined by first and second side walls and by top and bottom walls that are orthogonal with respect to said first and second side walls; and

cutting said extruded material to a predetermined length.

10. The method of Claim 9 wherein the bottom wall of at least one of said calibrators define a generally continuous convex surface.
11. The method of Claim 10 wherein said bottom wall of at least one calibrator defines an arc of substantially constant radius.
12. The method of Claim 11 wherein the radius of the arc of said bottom wall of at least one calibrator is not less than 50 inches.
13. The method of Claim 12 wherein said generally continuous convex surface of the bottom wall of at least one of said calibrators has a first end that joins with the respective first side wall of said calibrator and said generally continuous convex surface of the bottom wall also has a second end that joins with the respective second side wall.
14. The method of Claim 13 wherein the junction of the first end of said continuous convex wall and said first side wall defines a first curved shoulder and wherein the junction of the second end of said continuous convex wall and said second side wall defines a second curved shoulder.
15. The method of Claim 14 wherein said first curved shoulder defines a constant radius and where said second curved shoulder also defines a constant radius.
16. The method of Claim 15 wherein the radius of each of said first curved shoulder and said second curved shoulder is not greater than substantially 0.25 in.
17. The method of Claim 16 further comprising the step of;  
embossing the top surface of said extruded material to provide an embossed pattern in the surface thereof.
18. A composite deck plank made according to the process comprising the steps of:

blending polyvinyl chloride with glass fibers that have a screen size in the range of 1/64 inch to 1/4 inch to make a polyvinyl chloride/glass melt in which the glass fibers are imbedded in the polyvinyl chloride;

exposing the polyvinyl chloride/glass melt to a blowing agent to form voids in the polyvinyl chloride/glass melt;

extruding the polyvinyl chloride/glass melt having included voids through a die, said extrusion die having an opening therein that is defined by first and second side surfaces that are oppositely disposed from each other and by top and bottom surfaces that are also oppositely disposed from each other and that are substantially orthogonal with respect to said first and second side surfaces;

pulling the extruded material through a calibration table wherein the extruded material is cooled as it passes through a plurality of calibrators that further define the external shape of the extruded material, each of said calibrators having a respective opening that is defined by first and second side walls and by top and bottom walls that are orthogonal with respect to said first and second side walls; wherein the bottom wall of at least one of said calibrators defines a generally continuous convex surface, and

cutting said extruded material to a predetermined length.

19. The composite deck plank of Claim 18 wherein the glass fibers have a fiber diameter in the range of 5 microns to 30 microns.
20. The composite deck plank of Claim 18 wherein the glass fibers have a fiber length in the range of 50 microns to 900 microns.
21. The composite deck plank of Claim 18 wherein the glass fibers have a bulk density in the range of 0.275 grams/cc to 1.05 grams/cc.

22. The composite deck plank of claim 18 wherein the polyvinyl chloride/glass melt is contained in an extruder barrel and wherein said step of exposing the polyvinyl chloride/glass melt to a blowing agent further includes injecting a physical blowing agent through the extruder barrel into the polyvinyl chloride/glass melt.

23. The composite deck plank of Claim 18 wherein said blowing agent is mixed with a carrier material.

24. The composite deck plank of Claim 23 wherein said carrier material is selected from the group of calcium carbonate, polyvinyl chloride, or ethylene vinyl acetate.

25. A process for making deck planks, said process comprising the steps of:

combining polyvinyl chloride, glass fibers, and a blowing agent to form a feed mixture.

providing the feed mixture to an extruder, said extruder increasing the temperature and pressure on the feed mixture to form a polyvinyl chloride/glass melt wherein the concentration of said glass fibers is in the range of 1% to 18% by weight;

extruding the polyvinyl chloride/glass melt having included voids through a die, said extrusion die having an opening therein that is defined by first and second side surfaces that are oppositely disposed from each other and by top and bottom surfaces that are also oppositely disposed from each other and that are substantially orthogonal with respect to said first and second side surfaces;

pulling the extruded material through a calibration table wherein the extruded material is cooled as it passes through a plurality of calibrators that further define the external shape of the extruded material, each of said calibrators having a respective opening that is defined by first and second side walls and by top and bottom walls that

are orthogonal with respect to said first and second side walls; wherein the bottom wall of at least one of said calibrators defines a generally continuous convex surface, and

cutting said extruded material to a predetermined length.

26. The process of Claim 25 wherein the blowing agent is a chemical blowing agent that is mixed with the polyvinyl chloride and glass fibers prior to formation of the polyvinyl chloride/glass melt, said chemical blowing agent cooperating with the polyvinyl chloride/glass melt to form voids in the polyvinyl chloride/glass melt and in the extruded shape.

27. The process of Claim 25 wherein said blowing agent is mixed with a carrier material.

28. The process of Claim 27 wherein said carrier material is selected from the group of calcium carbonate, polyvinyl chloride, or ethylene vinyl acetate.

29. The process of Claim 25 wherein the chemical blowing agent is azodicarbonamide.

30. The process of Claim 25 wherein the blowing agent that is mixed with the polyvinyl chloride/glass melt is carbon dioxide.

31. The process of Claim 25 wherein the blowing agent that is mixed with the polyvinyl chloride/glass melt is nitrogen.

32. The process of Claim 25 wherein the blowing agent that is mixed with the polyvinyl chloride/glass melt is from the chlorofluorocarbon family of gases.

33. The process of Claim 25 wherein the blowing agent that is mixed with the polyvinyl chloride/glass melt is from the butane family of gases.

34. A composite deck plan made according to the steps comprising:

providing a feed mixture to an extruder, said feed mixture including polyvinyl chloride and glass fibers, said polyvinyl chloride being in an amount of about 82% to 99% by weight of the mixture and said glass fibers being in an amount of about 1% to 18% by weight of the mixture;

compressing said feed material in the extruder to increase the pressure and temperature of the feed material to form a polyvinyl chloride melt having glass fibers mixed therein;

mixing the polyvinyl chloride/glass melt with a blowing agent to establish closed voids within the melt;

extruding the polyvinyl chloride/glass melt having included voids through a die, said extrusion die having an opening therein that is defined by first and second side surfaces that are oppositely disposed from each other and by top and bottom surfaces that are also oppositely disposed from each other and that are substantially orthogonal with respect to said first and second side surfaces;

pulling the extruded material through a calibration table wherein the extruded material is cooled as it passes through a plurality of calibrators that further define the external shape of the extruded material, each of said calibrators having a respective opening that is defined by first and second side walls and by top and bottom walls that are orthogonal with respect to said first and second side walls; wherein the bottom wall of at least one of said calibrators defines a generally continuous convex surface, and

cutting said extruded material to a predetermined length.

35. The deck plank that is made according to the steps of Claim 34 wherein said blowing agent is a compressed gas that is inert to the polyvinyl chloride and glass fibers and that is injected into the extruder to mix with the polyvinyl chloride/glass melt.

36. The deck plank that is made according to the steps of Claim 35 wherein said injected blowing agent is nitrogen.

37. The deck plank that is made according to the steps of Claim 35 wherein said injected blowing agent is carbon dioxide.

38. The deck plank that is made according to the steps of Claim 35 wherein said injected blowing agent is in the family of butanes.

39. The deck plank that is made according to the steps of Claim 35 wherein said injected blowing agent is in the family of chloroflorocarbons.

40. The deck plank that is made according to the steps of Claim 34 wherein the blowing agent is a chemical blowing agent that is included as an ingredient in the feed mixture of polyvinyl chloride and glass, said chemical blowing agent being in the amount of 0.5% to 3% by weight of the feed mixture.

41. The deck plank made according to the steps of Claim 40 wherein the chemical blowing agent is azodicarbonamide.

42. The deck plank made according to the steps of Claim 40 wherein the chemical blowing agent is sodium bicarbonate.

43. The deck plank made according to the steps of Claim 40 wherein the chemical blowing agent is citric acid.

44. The deck plank made according to the steps of Claim 40 wherein the chemical blowing agent is at least two compounds selected from the group consisting of azodicarbonamide, citric acid, and sodium bicarbonate.